Introducing the IANA Functions to the LAC region

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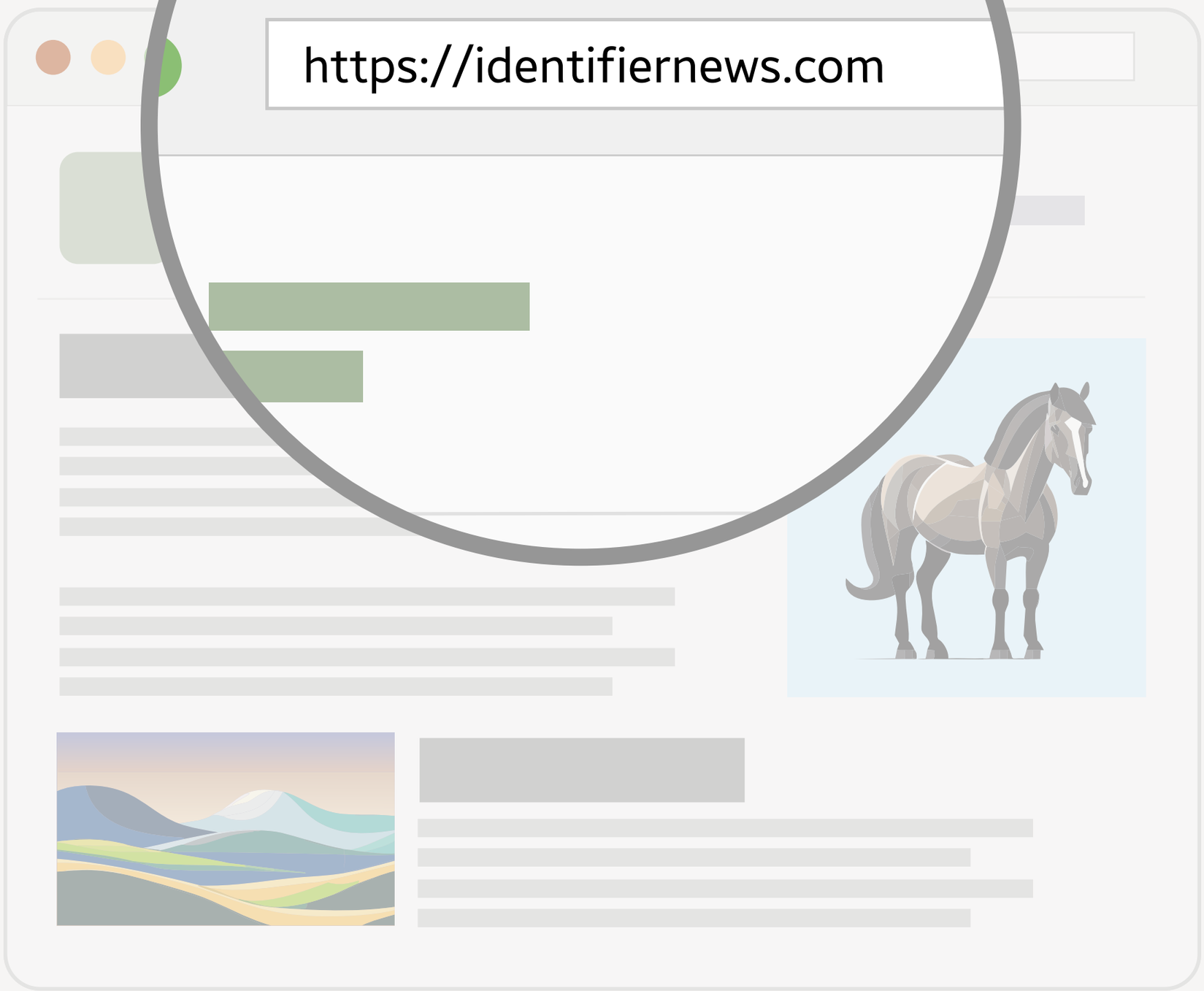
Unique identifiers

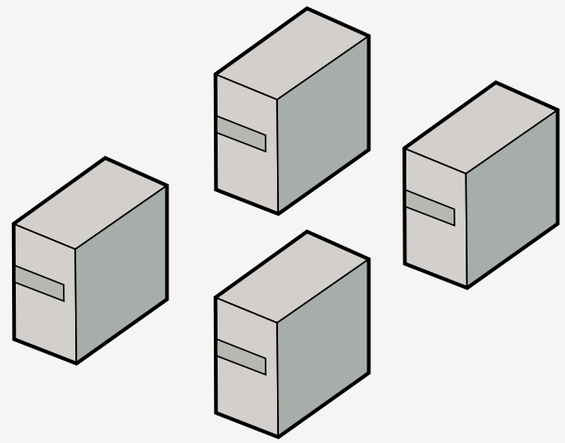
- Unique identifiers are at the heart of everything IANA, and our broader ICANN ecosystem, does.
- Let’s talk about what unique identifiers are and the role they play.

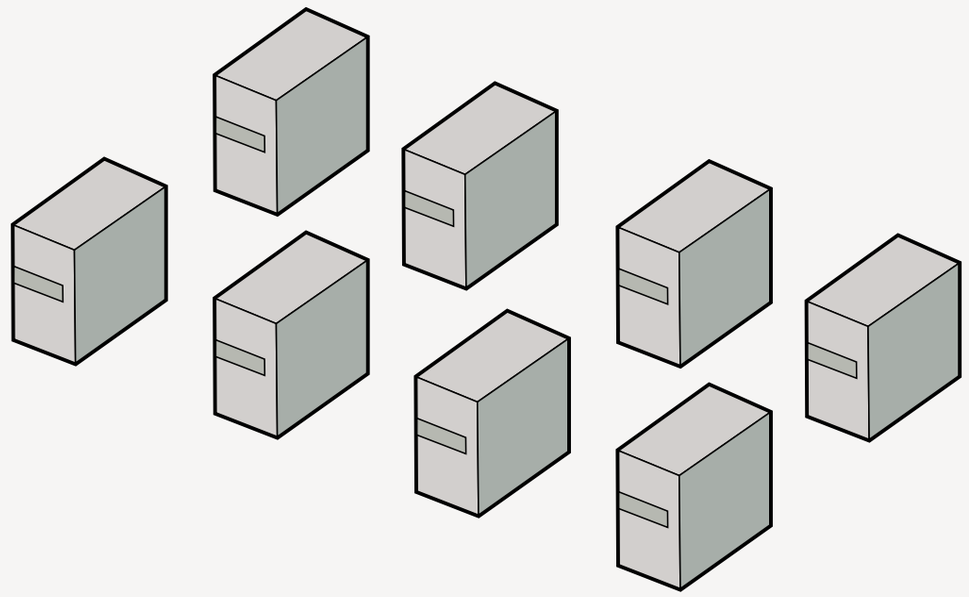
https://www.identifiernews.com

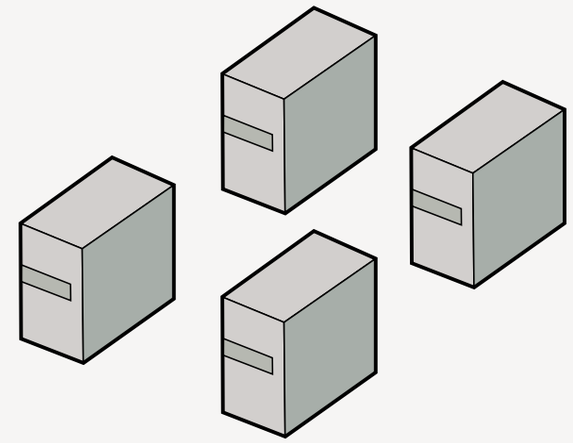

https://identifiernews.com

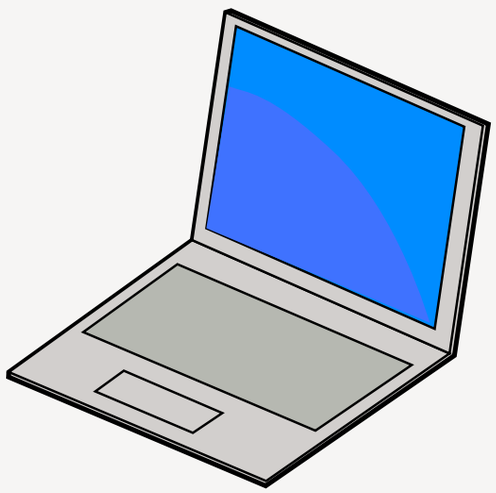
- `identifiernews.com` is a domain name, a human-readable address that provides a memorable means to communicate a location on the Internet.
- It forms part of a Uniform Resource Locator (URL), a common way of describing the location for something on the Internet.
- We use domain names every day for website locations, as a part of email addresses, and more.

- In a URL, how do we know what type of transmission is needed to get to the location?
- `https` is another part of the URL that signals the transmission method used to reach the location, known as a URI scheme.
- `https` is short for for Secure Hypertext Transmission Protocol, the standard way we transmit web pages in an encrypted manner
- There are others, like `http` for non-encrypted web pages, and `ftp` for File Transfer Protocol, or `rtsp` for Realtime Streaming Protocol.
- There are over 100 URI schemes.

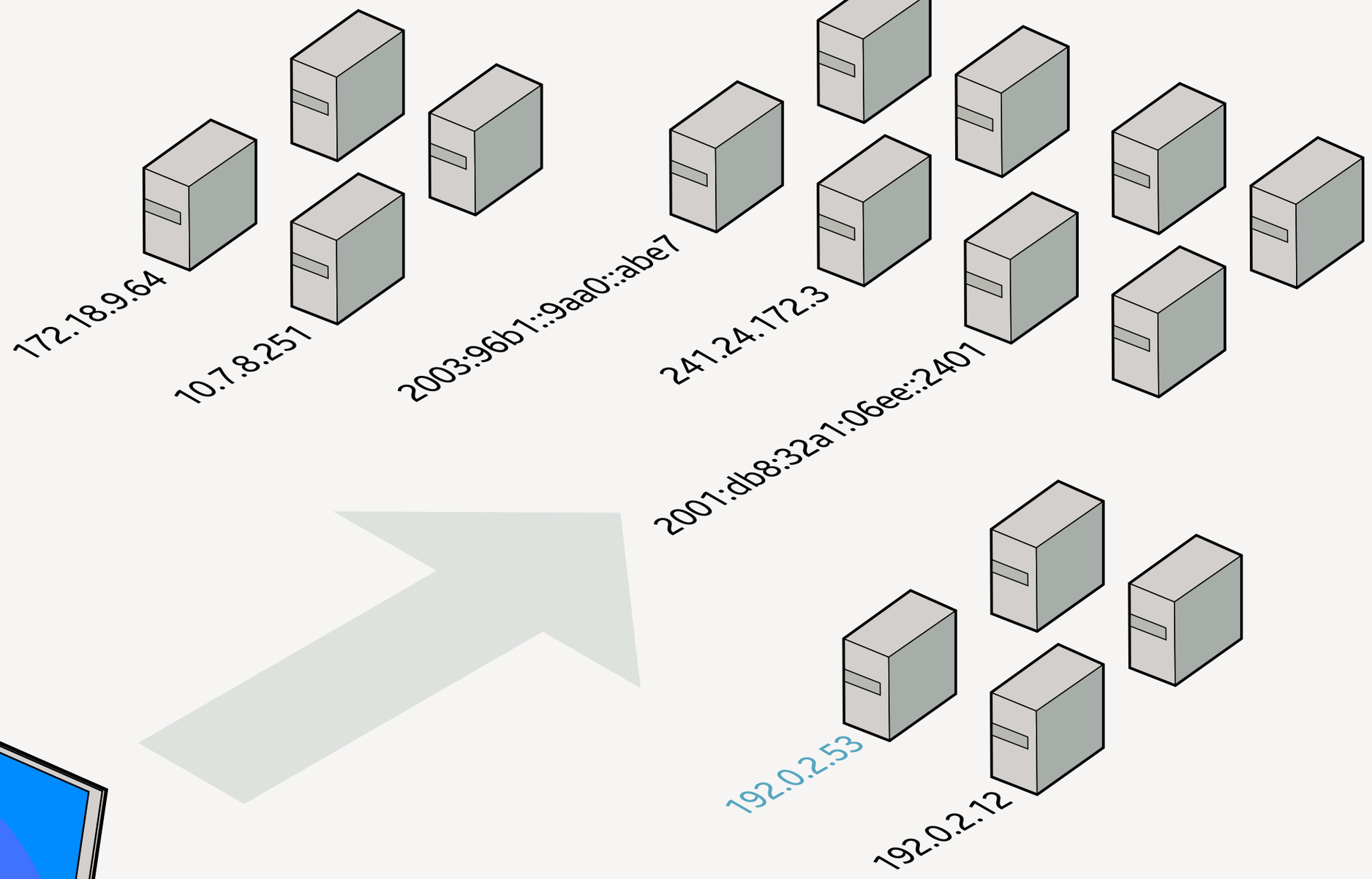


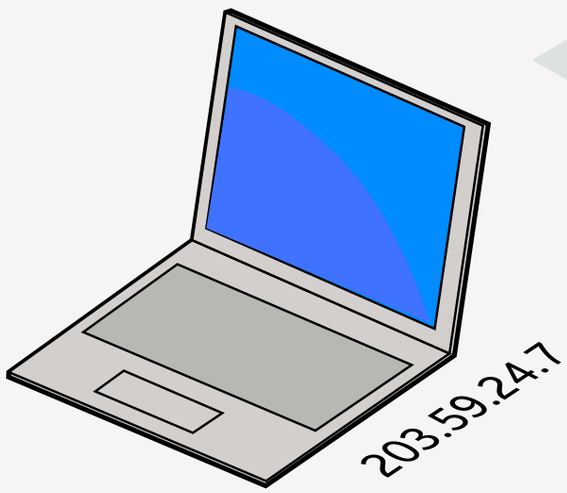




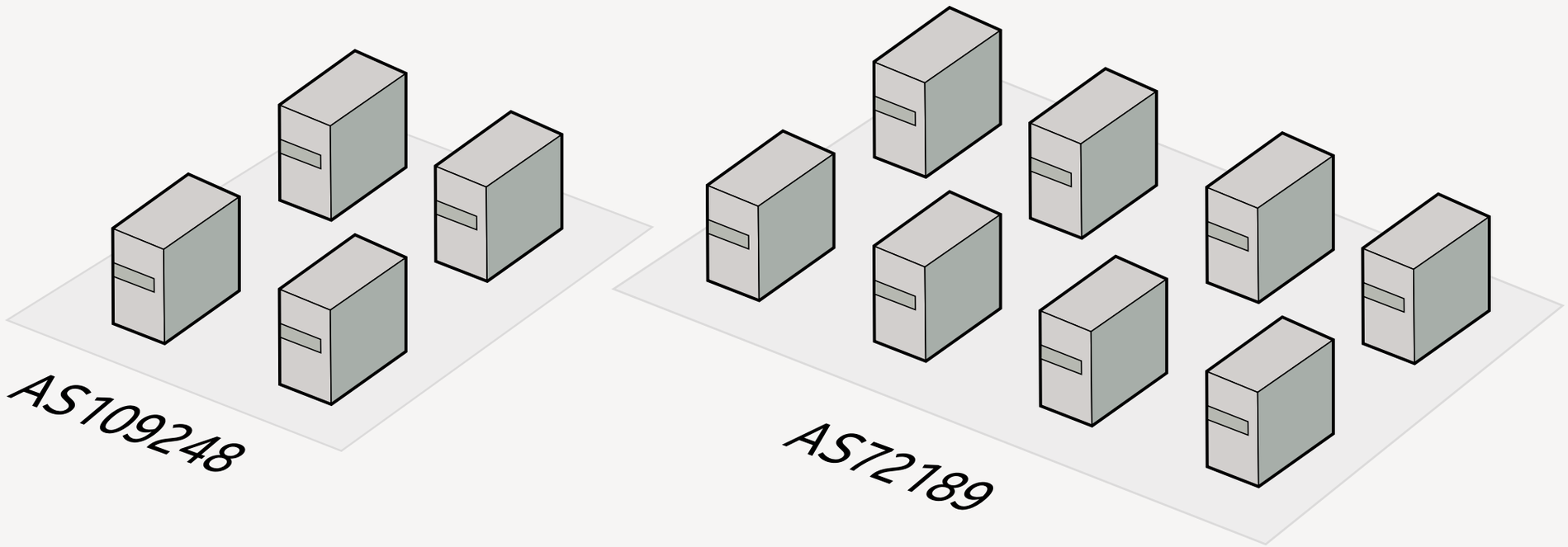


- Which server do we connect to to retrieve the data we want on the Internet?

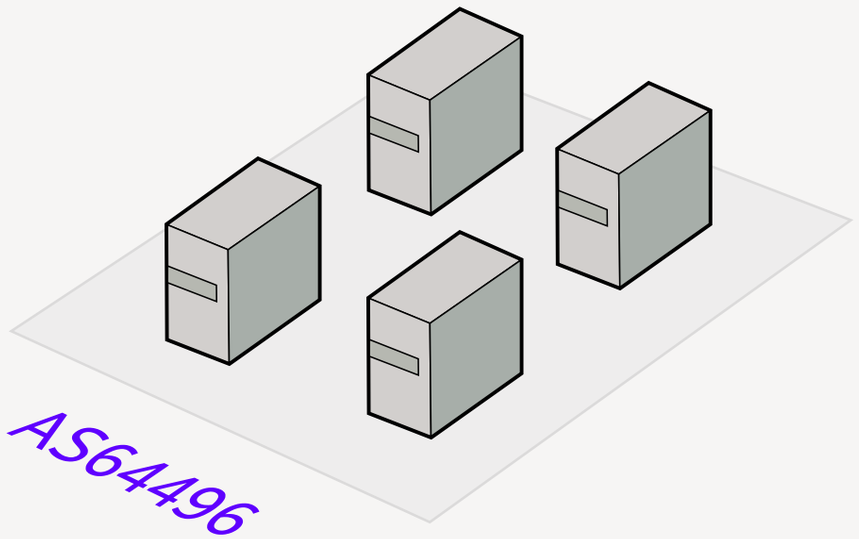




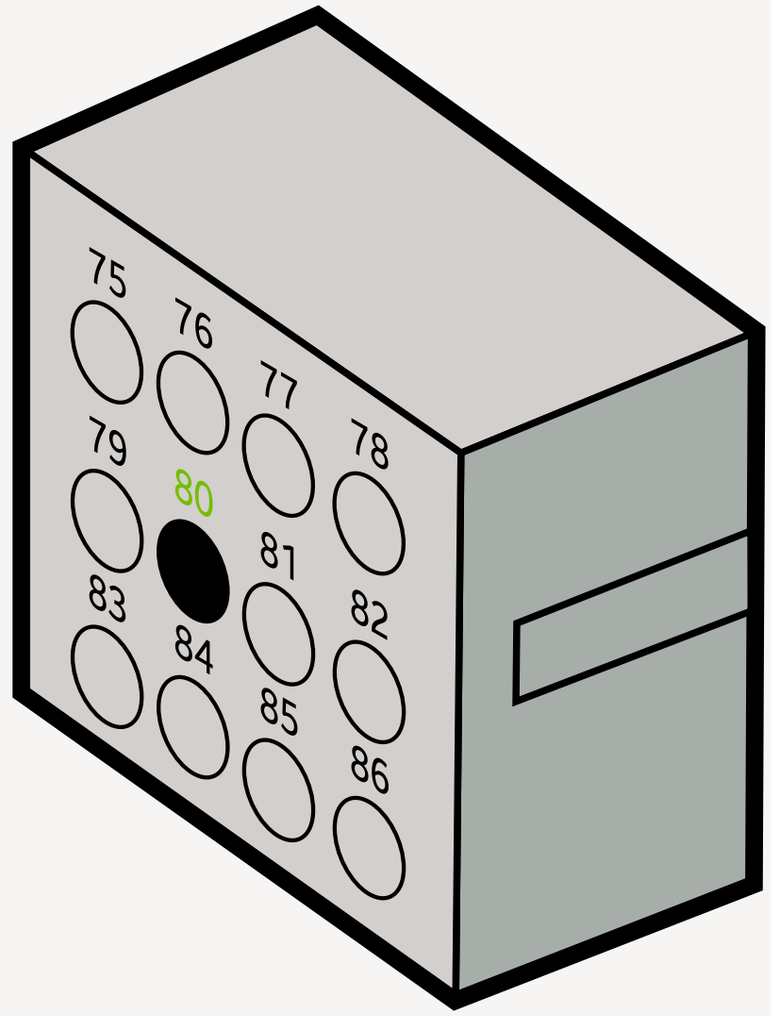
- Each device on the global network has a unique numerical identifier, called an IP address.
- Domain names are converted into these endpoint identifiers.

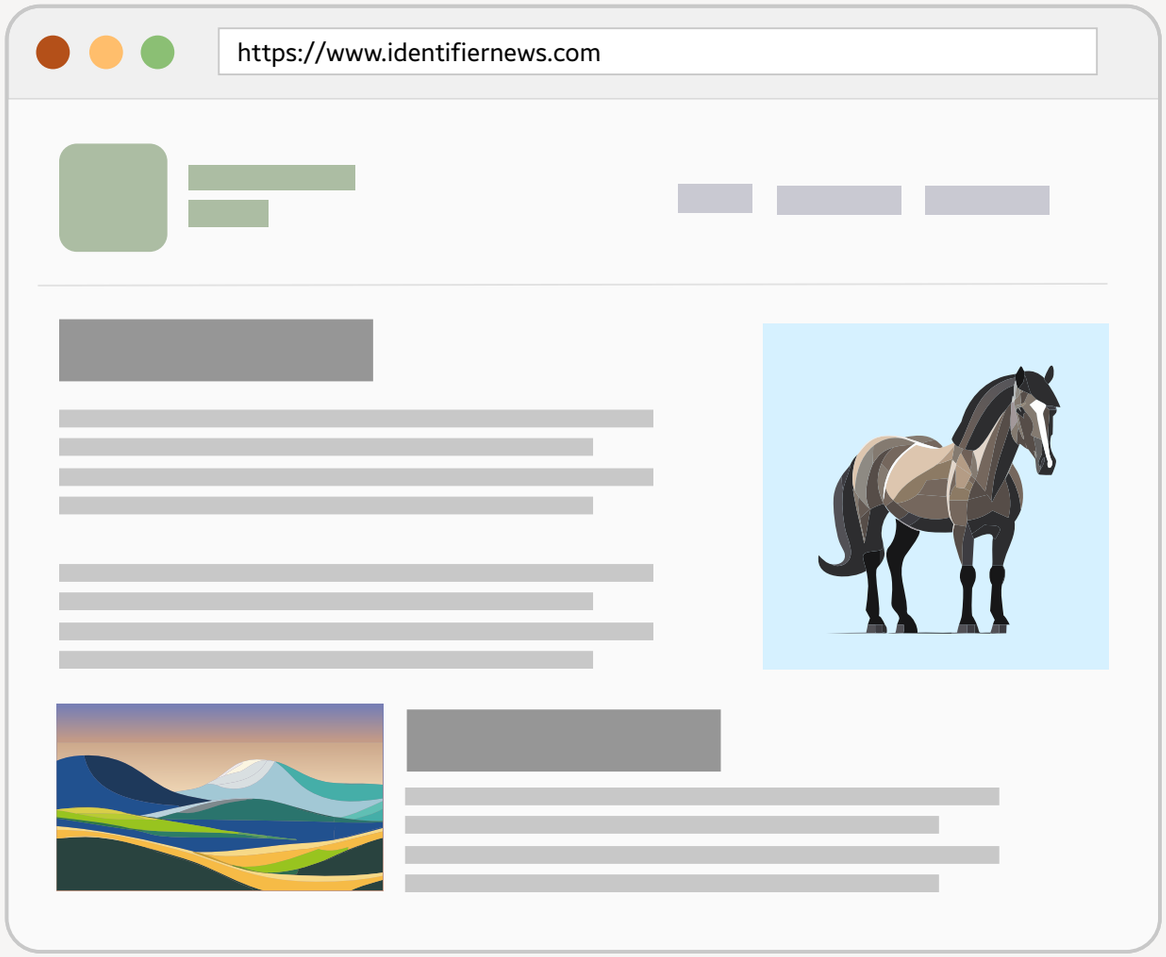


- The Internet is comprised of billions of devices, impossible to know where each is.
- Grouped into neighborhoods known as autonomous systems. Each neighborhood may be an ISP, a company, or a data center.
- Network operators only need to know the most efficient path between ASs without needing to know the location of each device.
- Only track the exact connection for each device in their own network.



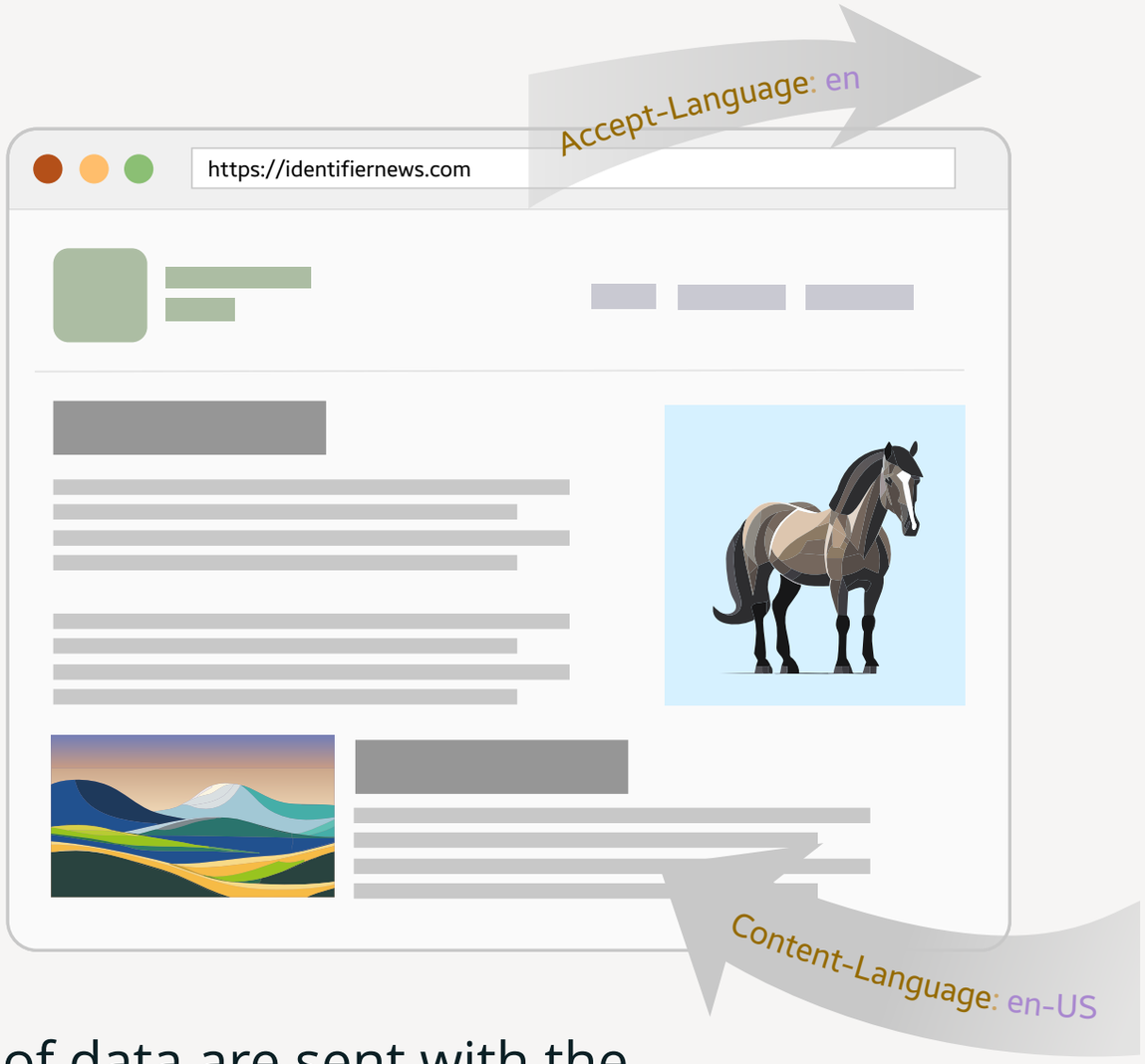
- Individual servers on the Internet often have multiple functions: serving websites, receiving email, offering file shares, running VPNs, hosting databases.
- Each service is defined with a port, so a network connection is made to the specific port related to the type of connection you want to establish. Services available are denoted by a service name, and usually a unique port number.
- When you're requesting a web page you may connect to port `80` (for web servers), rather than `25` (for email transmission)





- Our device connects to a server based on an IP address and port number, and gets back web page data.
- Web pages are comprised of lots of different types of data — text, graphics, movies, interactive elements. How does a recipient know the different possible encodings to make sense of it?

- Each piece of the transmission is coded with a media type which ties it to the underlying format. For example, video streaming may be `video/h264`, but a static photograph would be `image/jpeg`, wrapped in text defined with `text/html` and interactive elements coded in with `application/javascript`



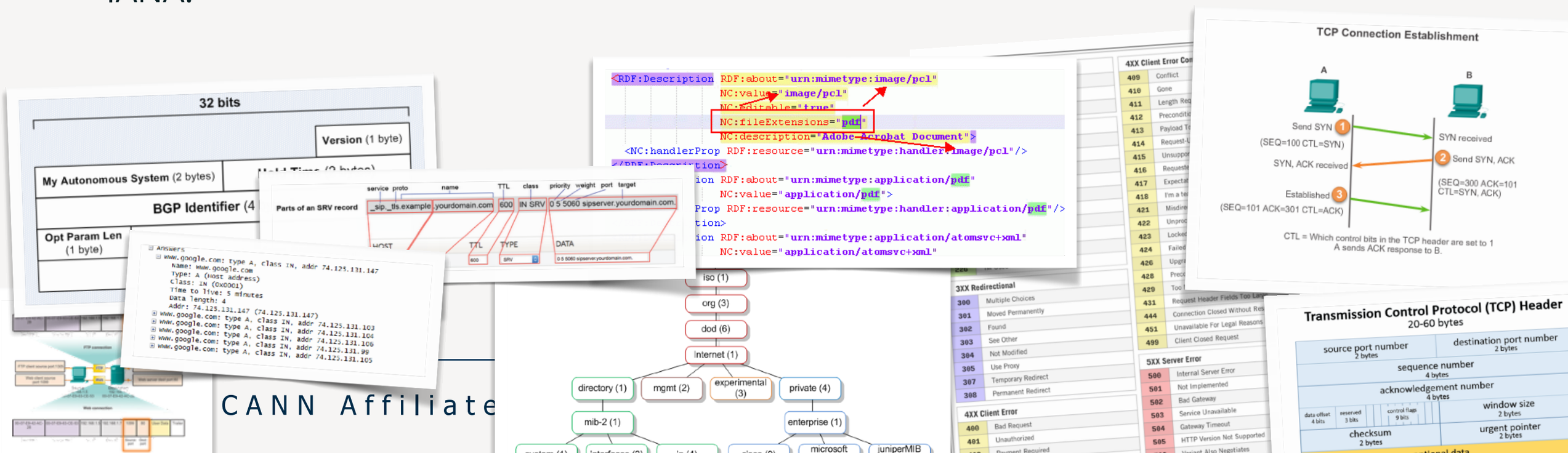
- When requesting a web page, additional bits of data are sent with the request to signal preferences and abilities of the web browser. These are denoted with header fields.
- One such field `Accept-Language`, signals language preference, so a website available in multiple languages will come back in the preferred language.
- Language choice is encoded using language tags. For example, `en` means English, and `en-US` means specifically American English.

Unique identifiers are everywhere

- You've now received your web page, and think about how all these unique identifiers were involved:
  - The domain name - the human-friendly address of the website;
  - The URI scheme - that tells your computer the language (protocol) it needs to speak to request the website;
  - The IP address - the machine-readable identifier of the server the web site is located at;
  - The AS number - the neighborhood the server is located in where your ISP needs to send your request to;
  - The service name and port number - that tells you which door to knock on at the server;
  - The media type - which helps your computer decode the data it gets back into pieces it can understand and represent on your screen;
  - The header field specifies extra data for requests and responses; and
  - A language tag signals the language desired, available and sent.

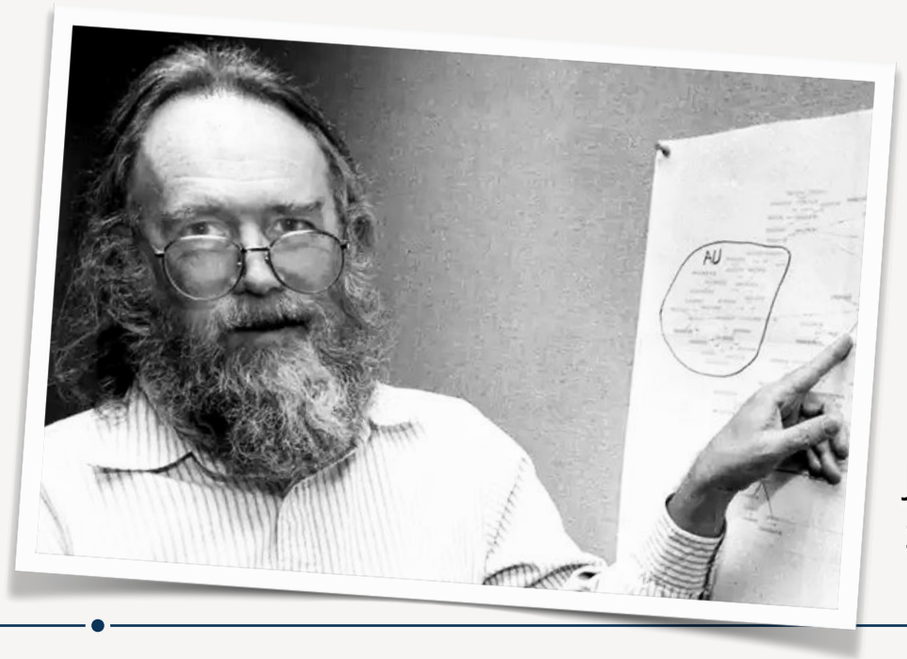
What do these all have in common?

- All of these unique identifiers are just a fraction of those necessary to transmit a single webpage across the Internet.
- Coordinating the Internet unique identifier systems is needed to ensure the Internet interoperates globally.
- If any one of those identifier types didn't have a common standardized meaning around the world, the web page would have failed to transmit across the Internet.
- **The IANA functions' responsibility is to manage all those identifiers globally.**
- This example only highlights 9 of around 3,500 identifier types managed by IANA.

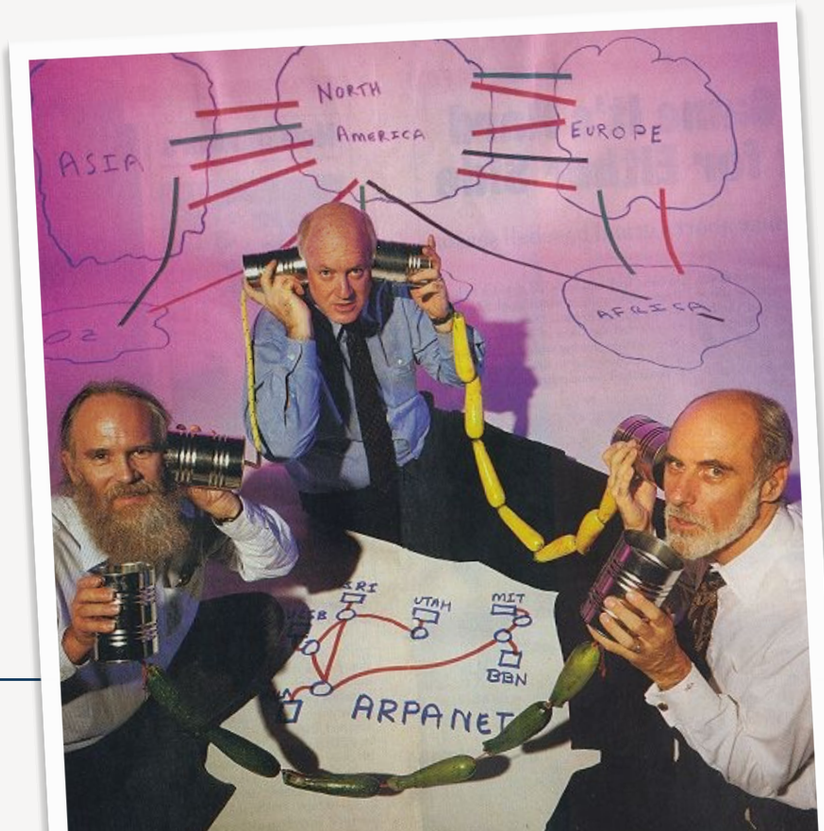


The IANA functions

- The record keeper for the unique names and numbers used by Internet technologies to interoperate.
- The IANA functions pre-date ICANN. In 1998, ICANN was established to be the home of the IANA functions with global oversight.
- The IANA team maintains these records according to policies established in standards organizations and by the multi-stakeholder Internet governance community.



Jon Postel (L) started the IANA; with Steve Crocker and Vint Cerf (R)



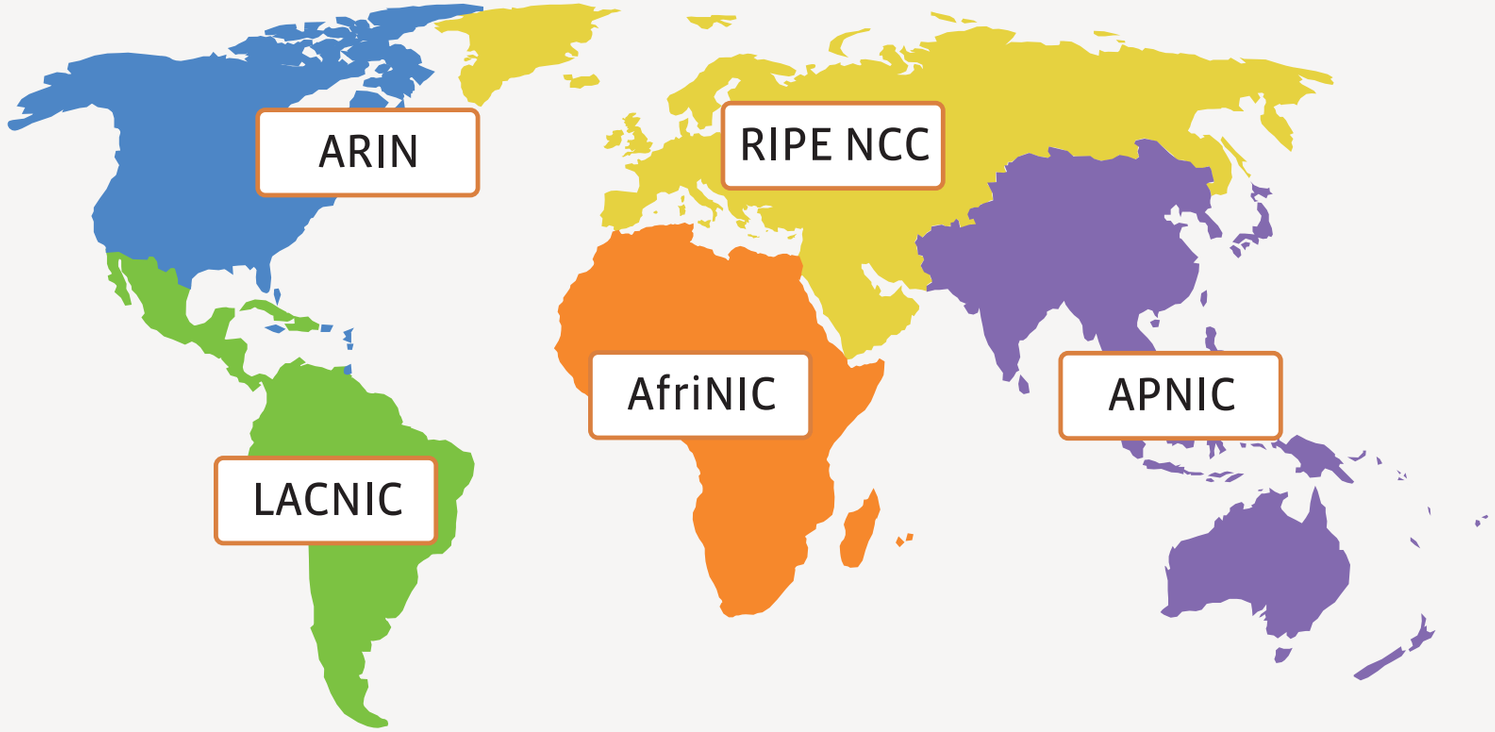
Let’s drill down into some areas of IANA operations

- Learn about the role of **Regional Internet Registries**
- How **country-code TLDs** are managed
- How **internationalization** works with domain names
- The utility of **key signing ceremonies**
- How **time zones** key the world synchronized

Number Resources and the RIRs

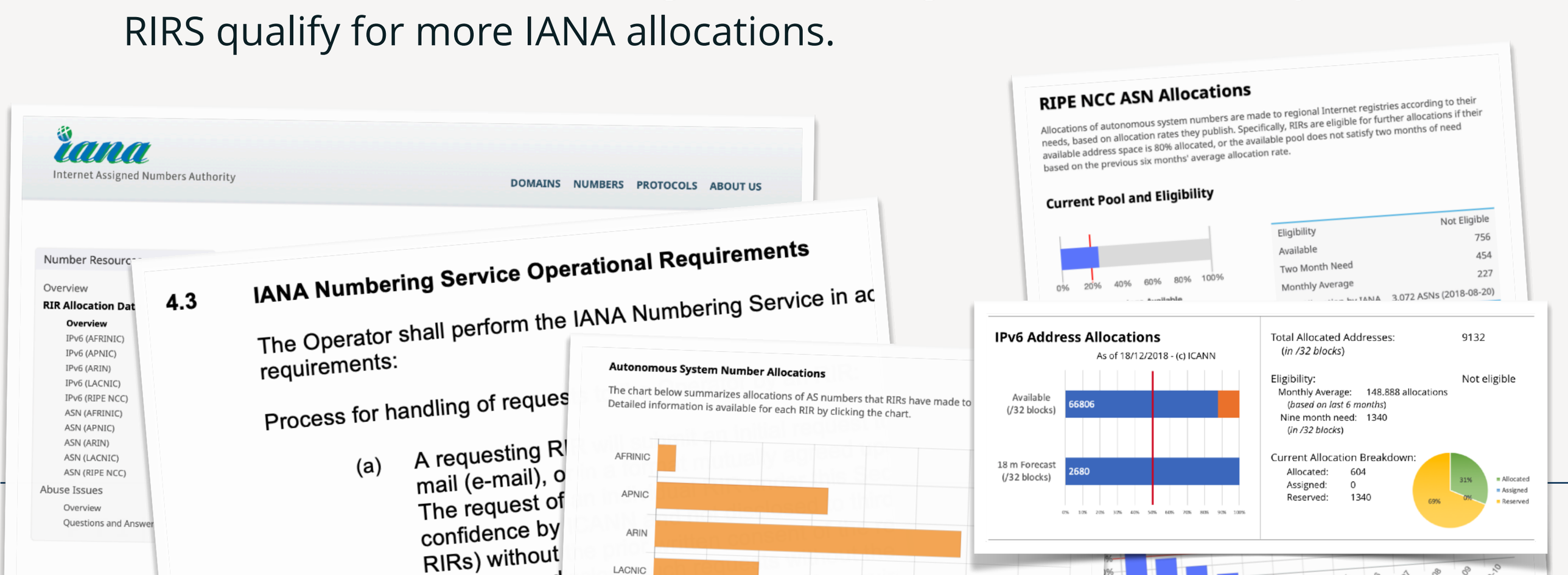
Number Allocation

- While IANA is responsible for the entire address space of these identifiers, customers who need general-use IP addresses and AS numbers do not come directly to IANA.
- Instead, they are distributed through a regional distribution system involving five **Regional Internet Registries**



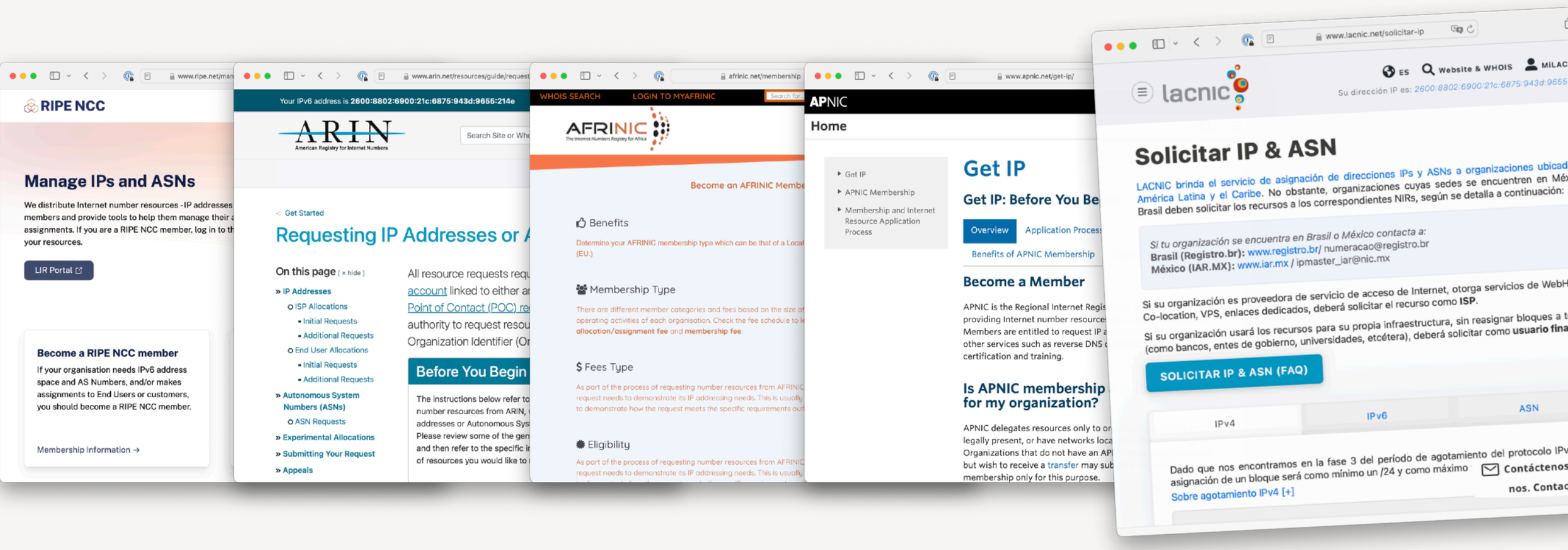
Allocation of Number Resources by IANA

- IANA allocates large blocks of IP addresses and ASNs to the five RIRs
  - These allocations are made according to global policies, established by ICANN's Address Supporting Organization (ASO)
- Allocations are made in compliance with service level agreements (SLAs) defined in the Service Level Agreement for the IANA Numbering Services
- Deterministic decision making is used, using formulas to identify when RIRS qualify for more IANA allocations.



Allocation of Number Resources by RIRs

- Each RIR operates in its own service region, and sets policies through its own communities and accountability mechanisms.
  - Periodical conferences and policy development apparatus
  - Similar to ICANN, but at a regional-level for number resources
- Network operators apply for resources in their respective region



Country-code top-level domains (ccTLDs)

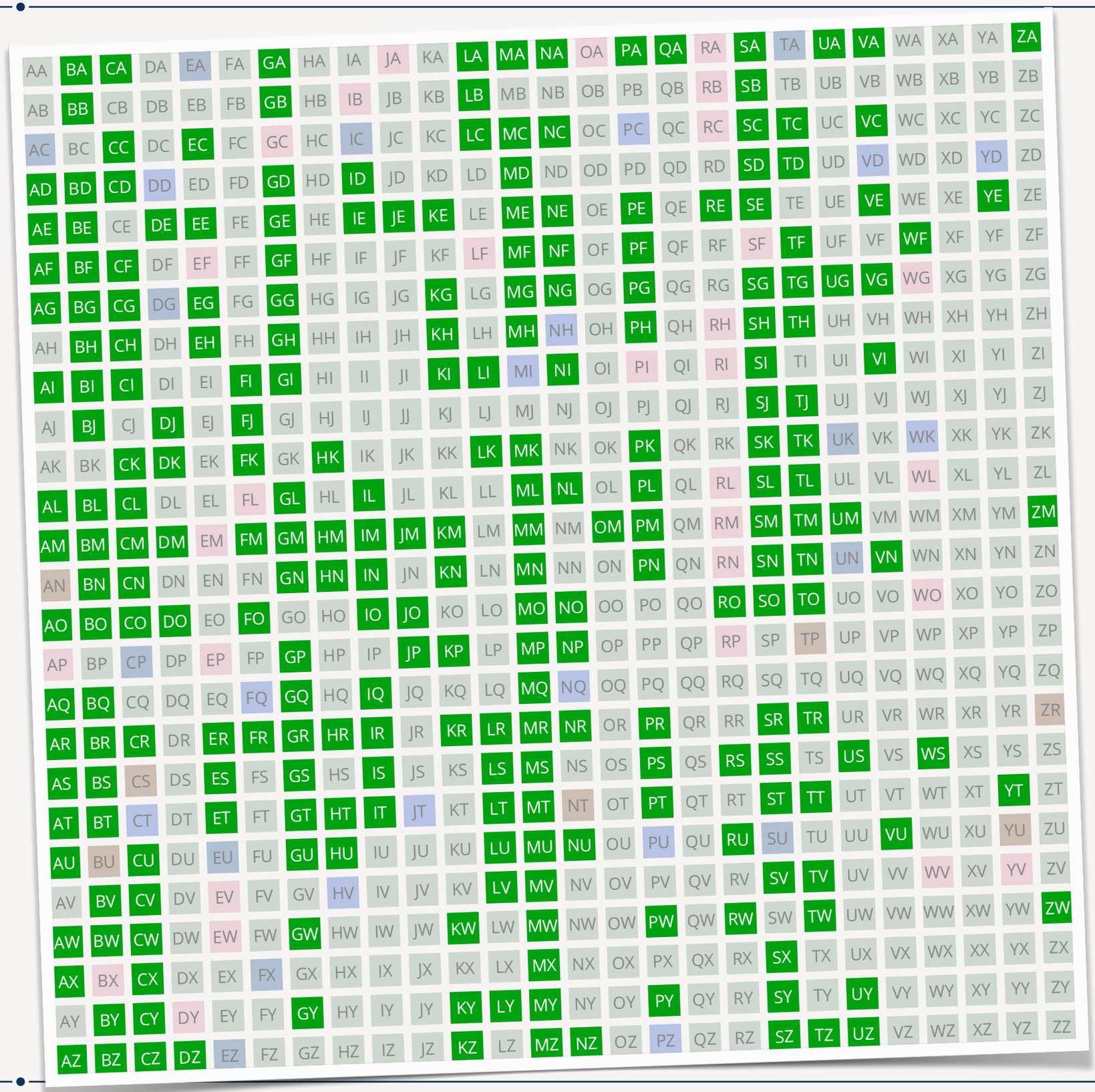
What are ccTLDs?

- We typically divide top-level domains into two broad categories:
  - **Generic Top-Level Domains (gTLDs)**
    - Global purpose
    - ICANN policy making and oversight
  - **Country-code Top-Level Domains (ccTLDs)**
    - Country-level purpose
    - Local policy making and oversight (within country)
    - Automatic qualification/disqualification
- Policy that applies at the global level is devised within two respective ICANN supporting organizations: the GNSO and ccNSO respectively.
- The enduring principles that define a ccTLD are contained in a seminal document “RFC 1591”, published in 1994 by Jon Postel

Country-code Top-Level Domains

- As the name implies, derived not from countries but from **country codes**
  - Country codes are specified by the international standard ISO 3166-1
  - This standard is used for many applications, not just ccTLDs (e.g. passports, currency, postal mail, even language subtags discussed earlier)
  - It provides alphabetical and numerical codings for countries and territories, ccTLDs only use one kind of coding — alpha-2 (two letters)
- It is both the arbiter of
  (a) what country/territory is eligible, and
  (b) what their code should be, based on the notion such decisions shouldn't be done by IANA.

ISO 3166-1 alpha-2 codes



ISO 3166-1 Codes

AA — Assigned in ISO 3166-1 standard

ISO 3166 MA Statuses

AA — Transitionally Reserved

AA — Exceptionally Reserved

AA — Indeterminately Reserved

How are ccTLDs managed?

- ccTLDs are intended to be managed within their respective jurisdiction
  - An appointed trustee (the “ccTLD Manager”) is responsible for all facets of ccTLD operation within the country
  - Local accountability
- IANA is responsible for evaluating requests to manage ccTLDs
  - Evaluates such requests on a number of policy criteria
  - Proceeds with requests when they satisfy all relevant criteria
  - Maintains an ongoing day-to-day operational relationship with the ccTLD manager to ensure the TLD continues to function (managing relevant data in the DNS root zone to enable the TLD)
  - Is not involved in day-to-day administration at the lower level (managing second-level registrations)

Policy responsibilities of ccTLD managers

- “trustees for the delegated domain, and have a **duty to serve the community**” … “both the nation, in the case of a country code, and the global Internet community”
- “Concerns about ‘rights’ and ‘ownership’ of domains are inappropriate. … be concerned about **‘responsibilities’ and ‘service’ to the community**.”
- “**equitable to all groups**”
- “**Significantly interested parties** in the domain should agree [the ccTLD manager]”
- “actual management of the assigning of domain names, delegating subdomains and operating nameservers must be **done with technical competence**”
- “This includes keeping [IANA] advised of the status of the domain, **responding to requests in a timely manner**, and operating the database with **accuracy, robustness, and resilience**”

Internationalized Domain Names (IDNs)

The original DNS

grancompania.co

- Letters a-z
- Digits 0-9
- Hyphens

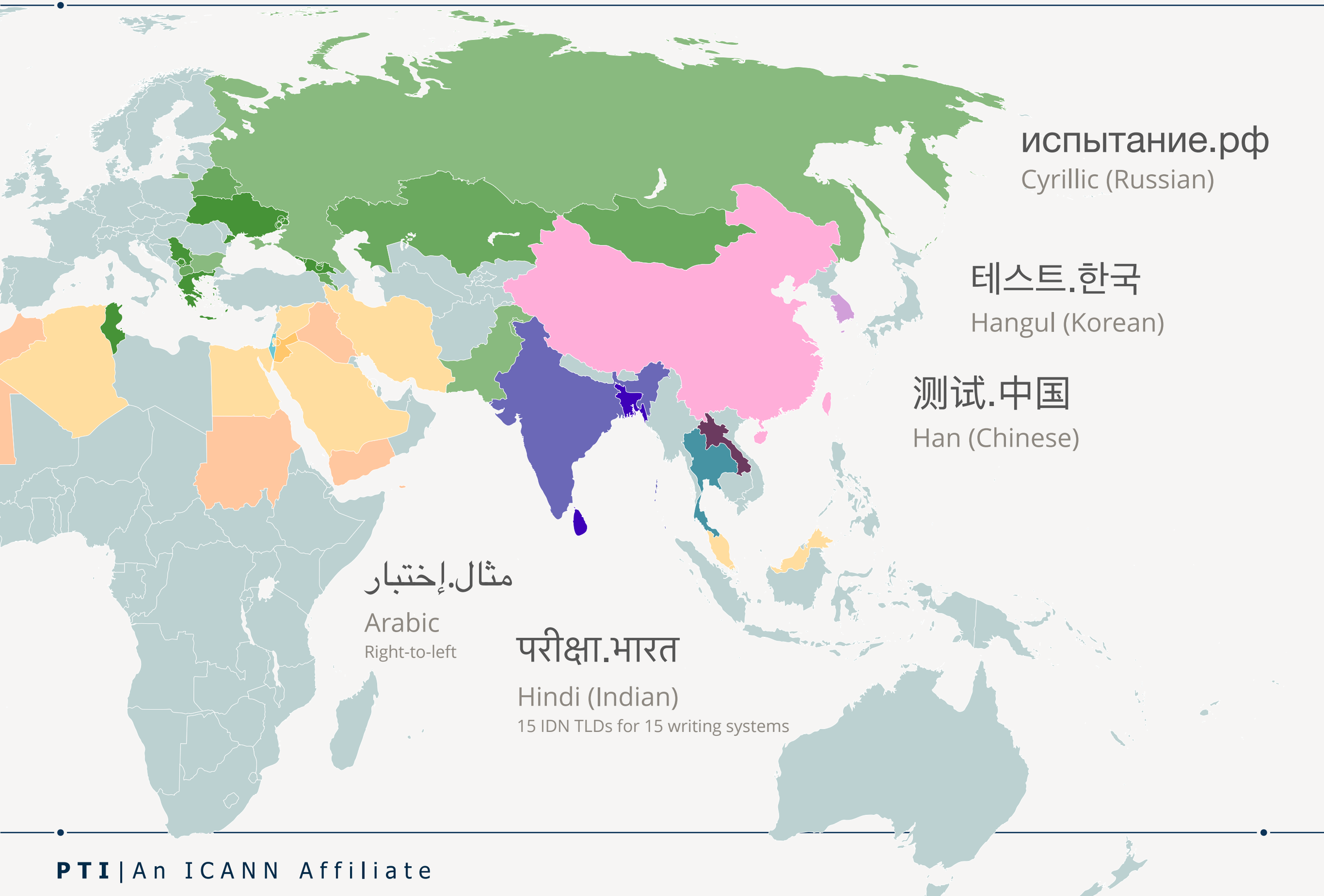
Internationalized Domain Names

grancompania.co

grancompañía.co

- Expressive beyond just what is provided by the ASCII (English) alphabet

Really useful for non-Latin scripts



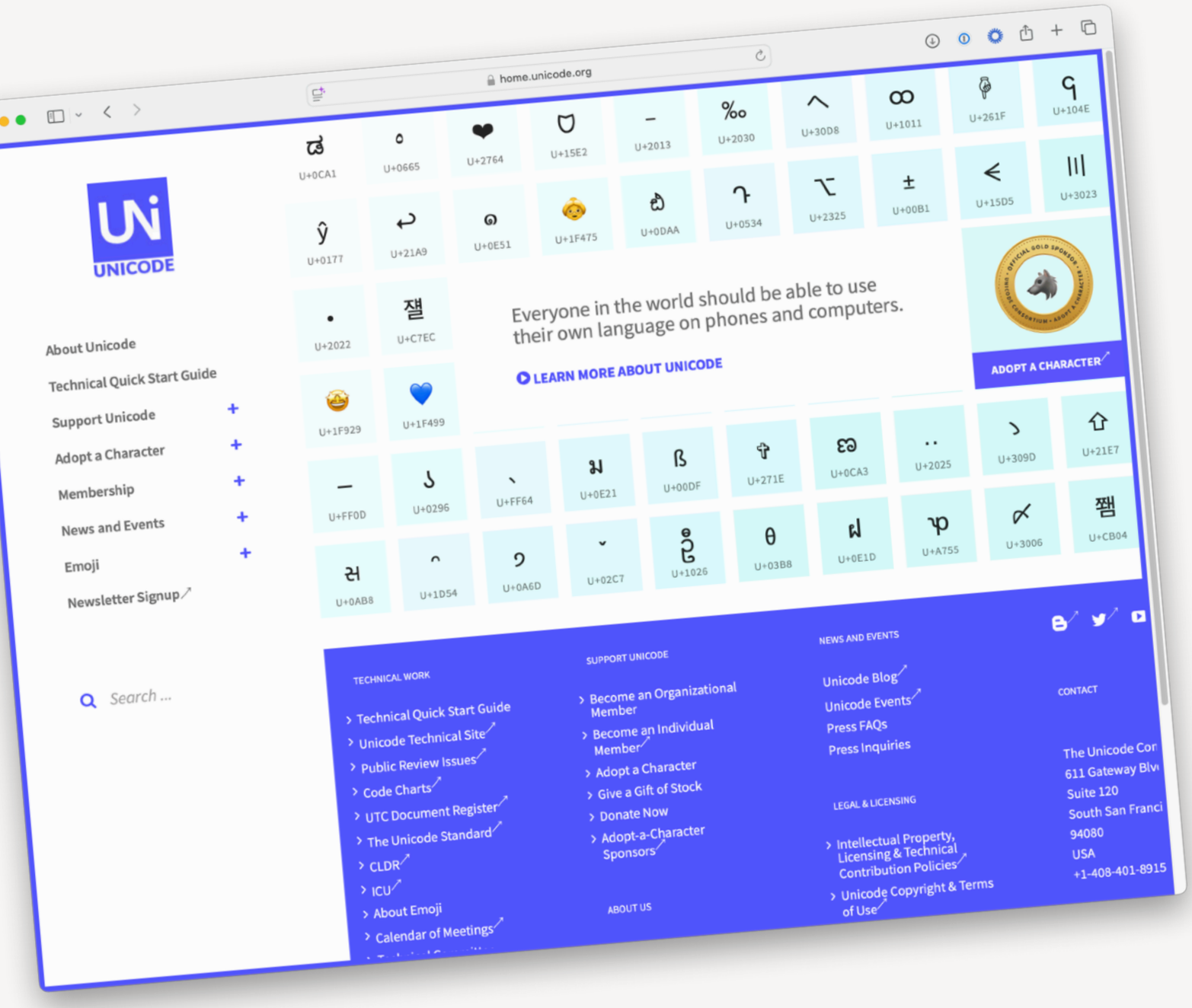
Internationalized Domain Names

grancompañía.co

xn--grancompaa-s8a1c.co

- Internally, still comprised of letters-digits-hyphens
- Algorithm converts between two representations

Based on Unicode



- 154,998 characters
  - 37 in LDH
- Aims to encapsulate all the world's writing systems

Unicode brings challenges

- So many letters in different writing systems look alike or are confusable
- Unicode encapsulates symbols and other elements used in written communication

- IDNA standard limits Unicode to only those that represent “letters” or letter-like things, no symbols or punctuation
- Special characters for things like joining have specific limited rules on where they can appear
- Much like the original LDH rules, constrains the possibilities to a reasonable subset

- Doesn’t solve all the problems — mitigating the issues requires domain registries to implement specific rules for specific languages, formerly known as “IDN tables”, now “Label Generation Rulesets”

Label Generation Rulesets

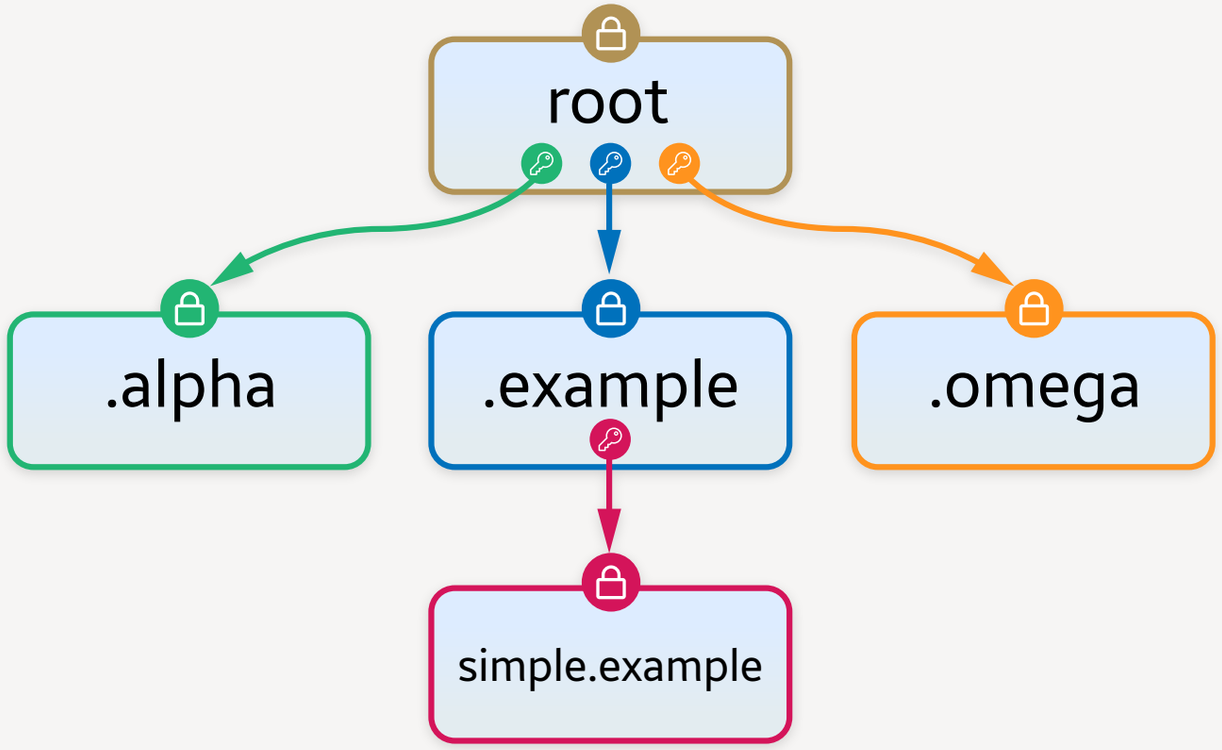
- Rules that govern which letters and characters are needed to represent specific languages
- You cannot commingle letters between languages to avoid confusability
- Context rules where they can be constructed
- Sets of code points that are interchangeable bundled together in “variant sets”

- IANA developed the technical standard (RFC 7940), and houses a global repository of these rulesets contributed by TLD registries
- ICANN has expert panels that develops common rules to be used at the root zone and to harmonize across different domains

DNS Security and Key Signing Ceremonies

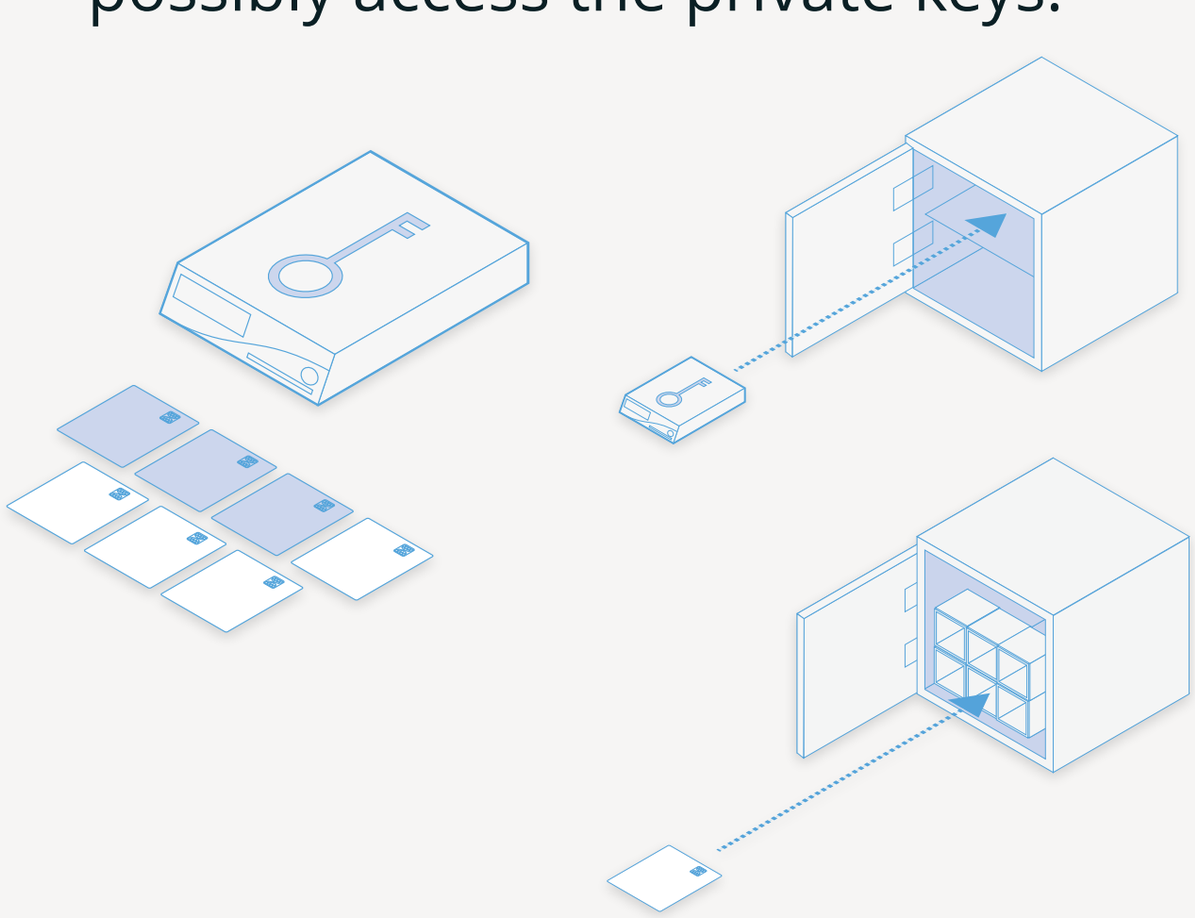
DNS Trust Anchor

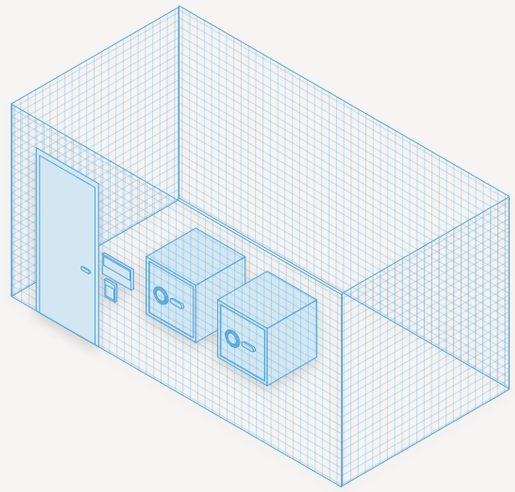
- Security for the DNS (DNSSEC) is a hierarchical system of public key cryptography that matches the hierarchical delegation of the DNS itself.
- The apex key is the **Root Zone Key Signing Key (KSK)**, which serves as the singular trust anchor for the system.
- In association with its role in managing the DNS root zone, IANA also manages the Root Zone KSK.

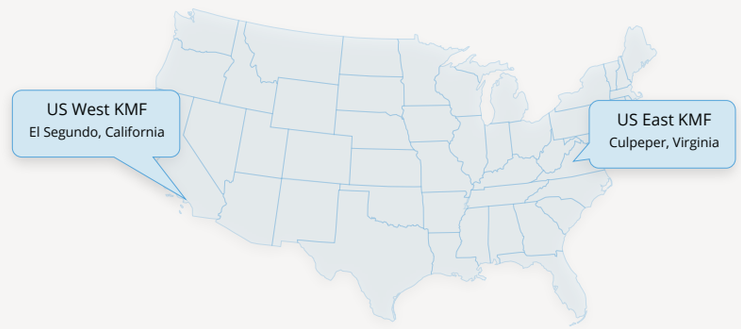


Key ceremonies

- Approximately four times a year, special events are held called key signing ceremonies. During these events, specialized equipment is used to generate the cryptographic signatures required to secure the DNS root zone.
- Access and roles are split among many people, so no one person can possibly access the private keys.

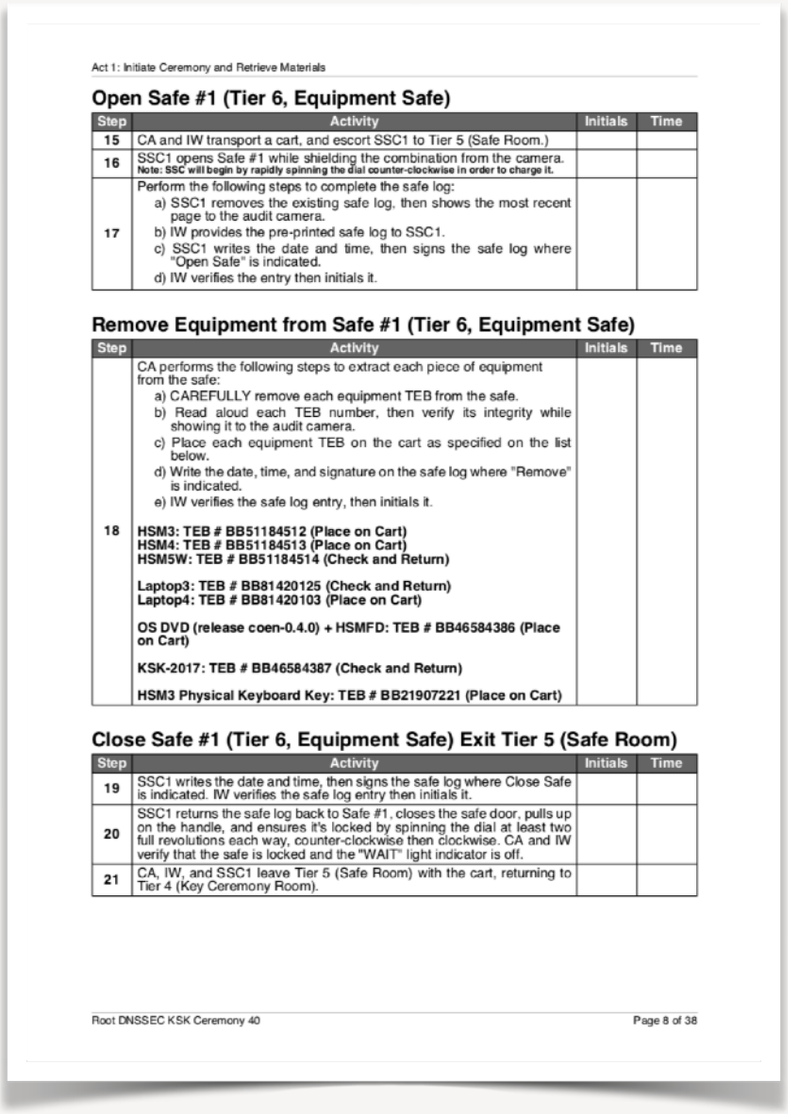






Key ceremonies

- Each ceremony is orchestrated using a comprehensive script that identifies each individual step that needs to be undertaken.



Act 1: Initiate Ceremony and Retrieve Materials

Open Safe #1 (Tier 6, Equipment Safe)

Step	Activity	Initials	Time
15	CA and IW transport a cart, and escort SSC1 to Tier 5 (Safe Room.)		
16	SSC1 opens Safe #1 while shielding the combination from the camera. **Note: SSC will begin by rapidly spinning the dial counter-clockwise in order to charge it.**		
17	Perform the following steps to complete the safe log: a) SSC1 removes the existing safe log, then shows the most recent page to the audit camera. b) IW provides the pre-printed safe log to SSC1. c) SSC1 writes the date and time, then signs the safe log where "Open Safe" is indicated. d) IW verifies the entry then initials it.		

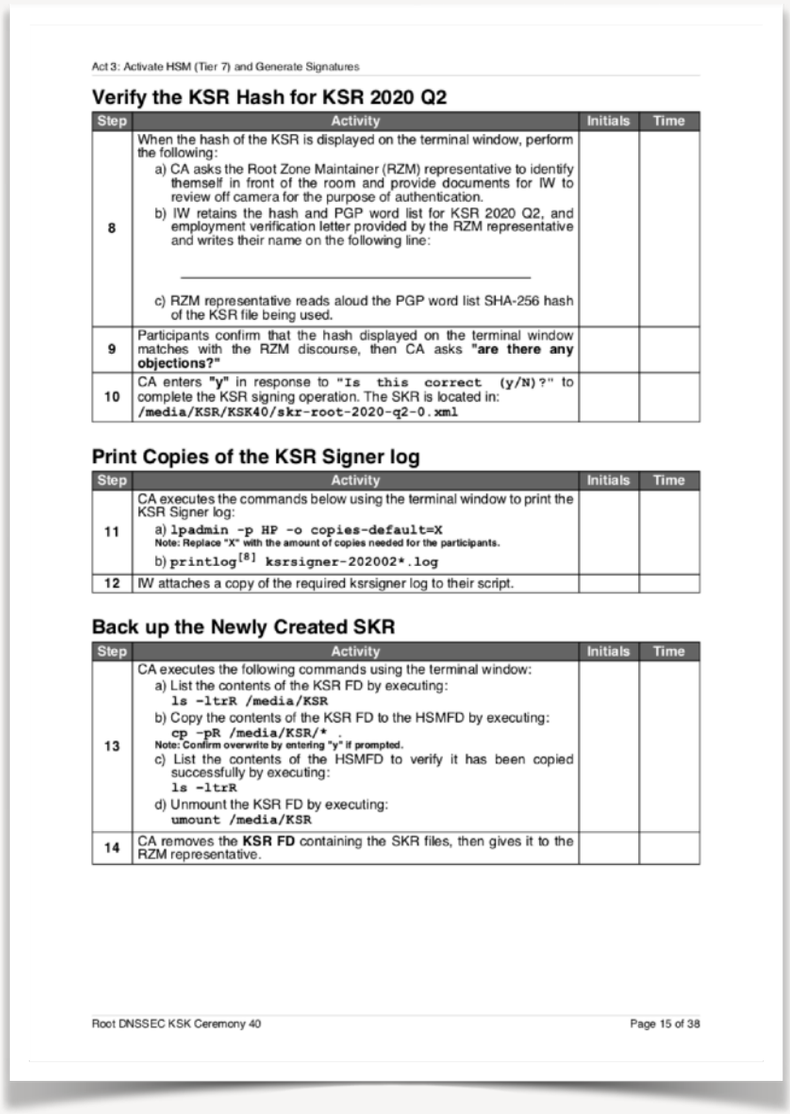
Remove Equipment from Safe #1 (Tier 6, Equipment Safe)

Step	Activity	Initials	Time
18	CA performs the following steps to extract each piece of equipment from the safe: a) CAREFULLY remove each equipment TEB from the safe. b) Read aloud each TEB number, then verify its integrity while showing it to the audit camera. c) Place each equipment TEB on the cart as specified on the list below. d) Write the date, time, and signature on the safe log where "Remove" is indicated. e) IW verifies the safe log entry, then initials it. **HSM3: TEB # BB51184512 (Place on Cart)** **HSM4: TEB # BB51184513 (Place on Cart)** **HSM5W: TEB # BB51184514 (Check and Return)** **Laptop3: TEB # BB81420125 (Check and Return)** **Laptop4: TEB # BB81420103 (Place on Cart)** **OS DVD (release coen-0.4.0) + HSMFD: TEB # BB46584386 (Place on Cart)** **KSK-2017: TEB # BB46584387 (Check and Return)** **HSM3 Physical Keyboard Key: TEB # BB21907221 (Place on Cart)**		

Close Safe #1 (Tier 6, Equipment Safe) Exit Tier 5 (Safe Room)

Step	Activity	Initials	Time
19	SSC1 writes the date and time, then signs the safe log where Close Safe is indicated. IW verifies the safe log entry then initials it.		
20	SSC1 returns the safe log back to Safe #1, closes the safe door, pulls up on the handle, and ensures it's locked by spinning the dial at least two full revolutions each way, counter-clockwise then clockwise. CA and IW verify that the safe is locked and the "WAIT" light indicator is off.		
21	CA, IW, and SSC1 leave Tier 5 (Safe Room) with the cart, returning to Tier 4 (Key Ceremony Room).		

Root DNSSEC KSK Ceremony 40 Page 8 of 38



Act 3: Activate HSM (Tier 7) and Generate Signatures

Verify the KSR Hash for KSR 2020 Q2

Step	Activity	Initials	Time
8	When the hash of the KSR is displayed on the terminal window, perform the following: a) CA asks the Root Zone Maintainer (RZM) representative to identify themself in front of the room and provide documents for IW to review off camera for the purpose of authentication. b) IW retains the hash and PGP word list for KSR 2020 Q2, and employment verification letter provided by the RZM representative and writes their name on the following line: _____ c) RZM representative reads aloud the PGP word list SHA-256 hash of the KSR file being used.		
9	Participants confirm that the hash displayed on the terminal window matches with the RZM discourse, then CA asks **"are there any objections?"**		
10	CA enters **"y"** in response to `"Is this correct (y/N)?"` to complete the KSR signing operation. The SKR is located in: `/media/KSR/KSK40/skr-root-2020-q2-0.xml`		

Print Copies of the KSR Signer log

Step	Activity	Initials	Time
11	CA executes the commands below using the terminal window to print the KSR Signer log: a) `lpadmin -p HP -o copies-default=X` **Note: Replace "X" with the amount of copies needed for the participants.** b) `printlog[8] ksrsigner-202002*.log`		
12	IW attaches a copy of the required ksrsigner log to their script.		

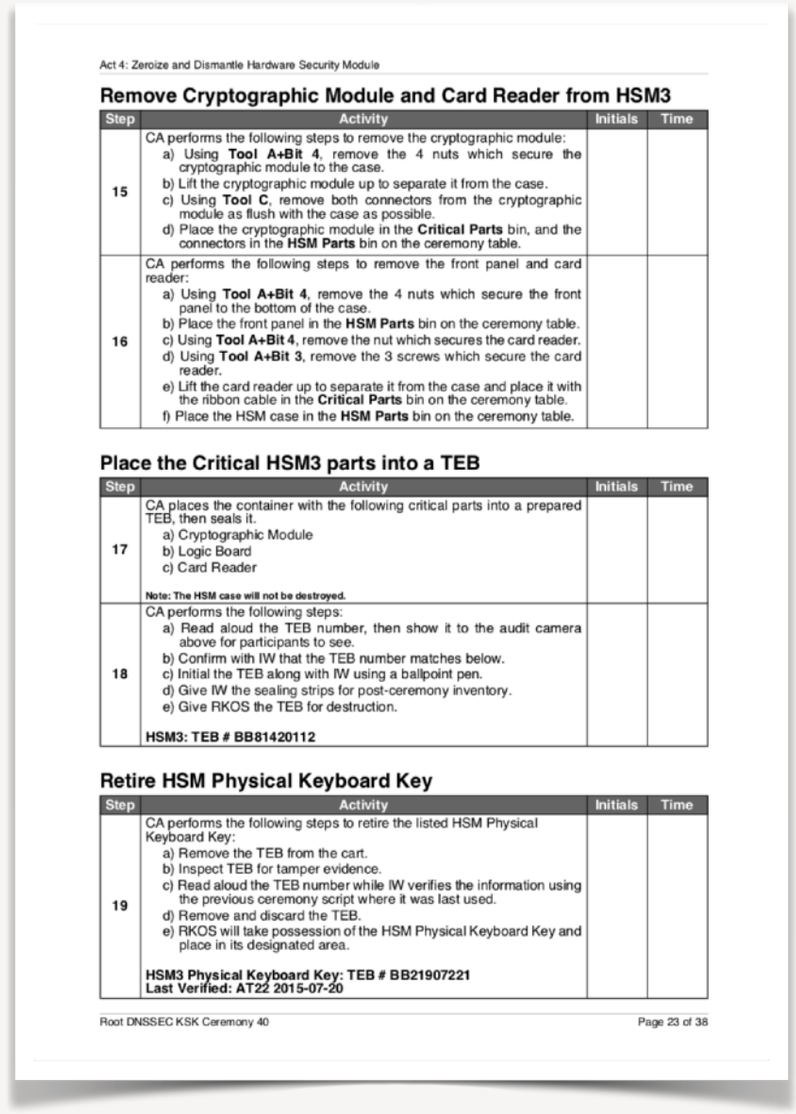
Back up the Newly Created SKR

Step	Activity	Initials	Time

13	CA executes the following commands using the terminal window:
	a) List the contents of the KSR FD by executing:
	`ls -ltrR /media/KSR`
	b) Copy the contents of the KSR FD to the HSMFD by executing:
	`cp -pR /media/KSR/* .`
	Note: Confirm overwrite by entering "y" if prompted.
	c) List the contents of the HSMFD to verify it has been copied successfully by executing:
	`ls -ltrR`
	d) Unmount the KSR FD by executing:
	`umount /media/KSR`		

14	CA removes the **KSR FD** containing the SKR files, then gives it to the RZM representative.		

Root DNSSEC KSK Ceremony 40 Page 15 of 38



Act 4: Zeroize and Dismantle Hardware Security Module

Remove Cryptographic Module and Card Reader from HSM3

Step	Activity	Initials	Time
15	CA performs the following steps to remove the cryptographic module: a) Using **Tool A+Bit 4**, remove the 4 nuts which secure the cryptographic module to the case. b) Lift the cryptographic module up to separate it from the case. c) Using **Tool C**, remove both connectors from the cryptographic module as flush with the case as possible. d) Place the cryptographic module in the **Critical Parts** bin, and the connectors in the **HSM Parts** bin on the ceremony table.		
16	CA performs the following steps to remove the front panel and card reader: a) Using **Tool A+Bit 4**, remove the 4 nuts which secure the front panel to the bottom of the case. b) Place the front panel in the **HSM Parts** bin on the ceremony table. c) Using **Tool A+Bit 4**, remove the nut which secures the card reader. d) Using **Tool A+Bit 3**, remove the 3 screws which secure the card reader. e) Lift the card reader up to separate it from the case and place it with the ribbon cable in the **Critical Parts** bin on the ceremony table. f) Place the HSM case in the **HSM Parts** bin on the ceremony table.		

Place the Critical HSM3 parts into a TEB

Step	Activity	Initials	Time
17	CA places the container with the following critical parts into a prepared TEB, then seals it. a) Cryptographic Module b) Logic Board c) Card Reader **Note: The HSM case will not be destroyed.**		
18	CA performs the following steps: a) Read aloud the TEB number, then show it to the audit camera above for participants to see. b) Confirm with IW that the TEB number matches below. c) Initial the TEB along with IW using a ballpoint pen. d) Give IW the sealing strips for post-ceremony inventory. e) Give RKOS the TEB for destruction. **HSM3: TEB # BB81420112**		

Retire HSM Physical Keyboard Key

Step	Activity	Initials	Time
19	CA performs the following steps to retire the listed HSM Physical Keyboard Key: a) Remove the TEB from the cart. b) Inspect TEB for tamper evidence. c) Read aloud the TEB number while IW verifies the information using the previous ceremony script where it was last used. d) Remove and discard the TEB. e) RKOS will take possession of the HSM Physical Keyboard Key and place in its designated area. **HSM3 Physical Keyboard Key: TEB # BB21907221** **Last Verified: AT22 2015-07-20**		

Root DNSSEC KSK Ceremony 40 Page 23 of 38

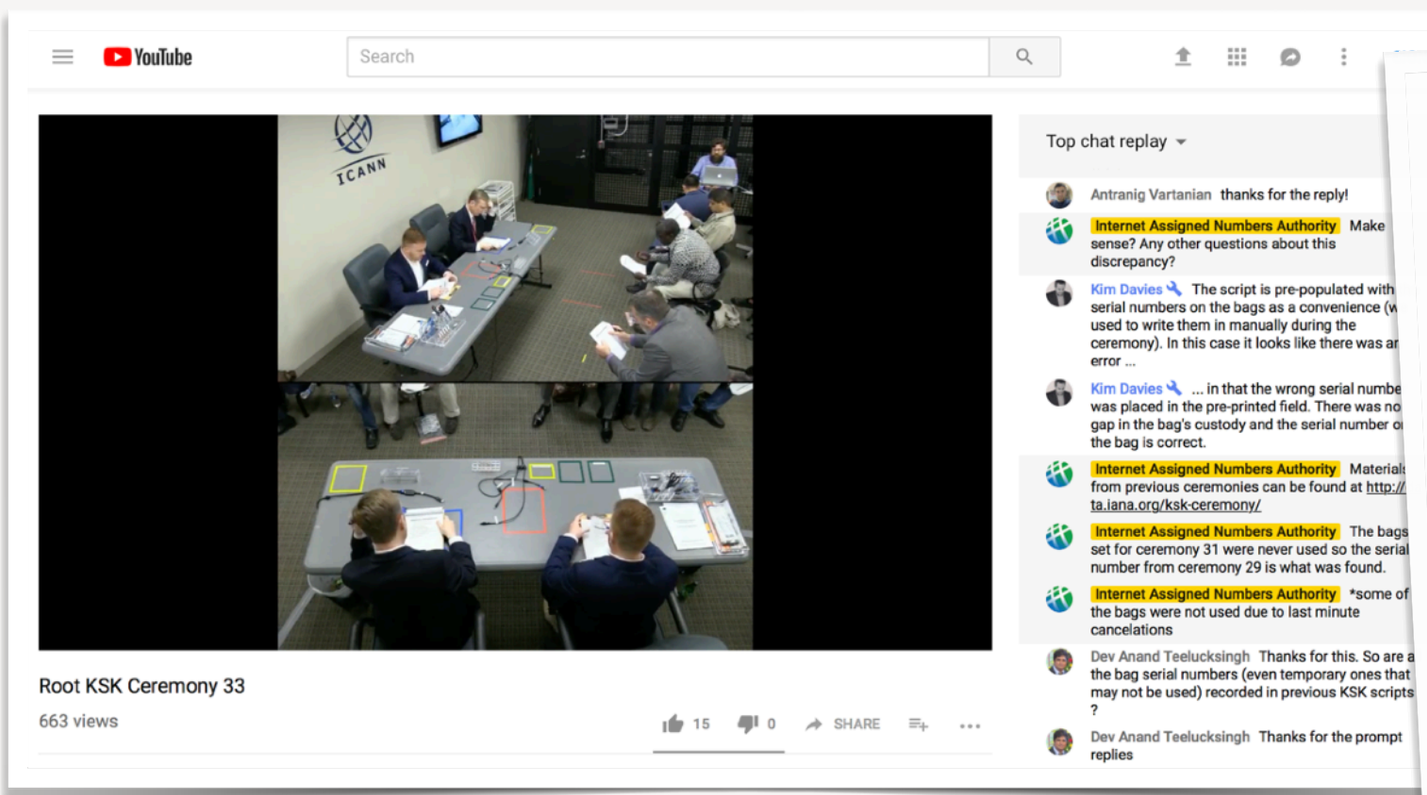
Trusted Community Representatives

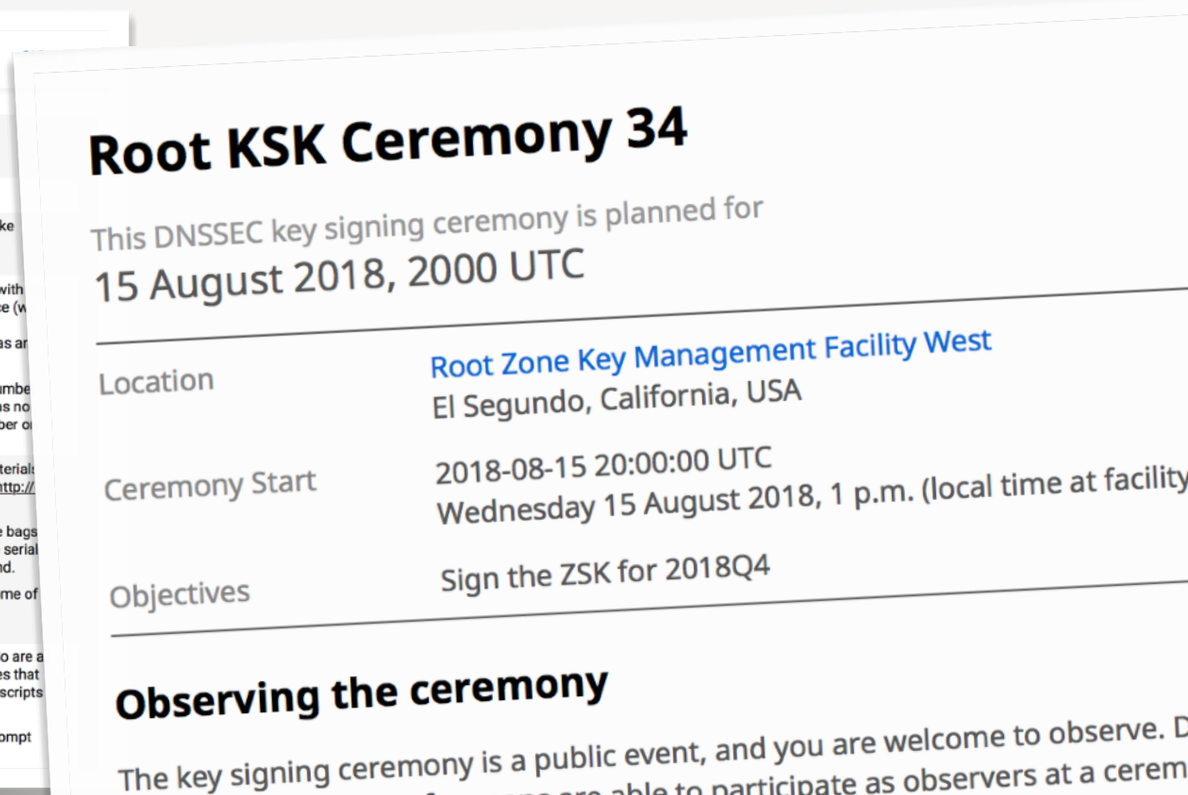
- We use **trusted community representatives**, security experts from around the world, in many of the critical roles in the ceremony.

- Current and former Latin American and Caribbean participants:
  - Hugo Salgado, Carlos Martinez, Jorge Etges, Sebastian Castro, Nicolas Antoniello

- New volunteers welcome at https://iana.org/tcr

- Beyond in person attendance, ceremonies are streamed online and media is often in attendance to explain the story.
- The purpose is to ensure **trust in the process**. DNSSEC only provides security if the community is confident the KSK has not been compromised.





Keeping the world on time

Time Zones

- In the past…
  - Time was calculated based in each locality based on the average of when the sun was at its highest being midday (**local mean time**).
    - Zero longitude, through Greenwich Observatory in London, became a reference point for others in this system (**Greenwich mean time**, or GMT)
      - For each degree of longitude, add/subtract 4 minutes
  - This was fine until consistency of time across multiple locations became a factor
    - Railway timetables motivated in moving beyond this system, railroad companies implemented the timezones we know today in 1883.
    - US Congress adopted the railroad's system as official US time in 1918.

Time Zones

- In modern era…
  - The time in a location is derived from a constant global source of time known as **Coordinated Universal Time** (UTC)
  - Rather than fractional offsets based on longitude of individual places, large bands of '**time zones**' mostly correlate to whole hour offsets
    - A few exceptions (e.g. Nepal is +5:45)
  - In World War I, the idea of shifting the time to promote daylight in the evenings was established in many locations (**daylight saving time**)
    - Used in the summer time when the sun rising early was not seen as advantageous

Time Zones

- On computers and devices on the Internet…
  - Computer devices generally store time in UTC, and use special protocols to sync over the Internet to keep time in sync with millisecond precision (NTP)
  - Specialized clocks, like atomic clocks, are used as a reference for NTP servers
  - UTC is good for computers who need consistent record keeping, but doesn’t help when you want something to happen at ‘4pm’

Date & Time

Show All

Date & Time | Time Zone | Clock

To select a time zone, click the map near your location and choose a city from the Closest City menu.
You can also have the time zone change automatically, if possible, based on your current location.

Set time zone automatically using current location

Time Zo

Closest C

Date and Time

Lock

Network Time

ON

23 : 01

April 23 2013

24-hour

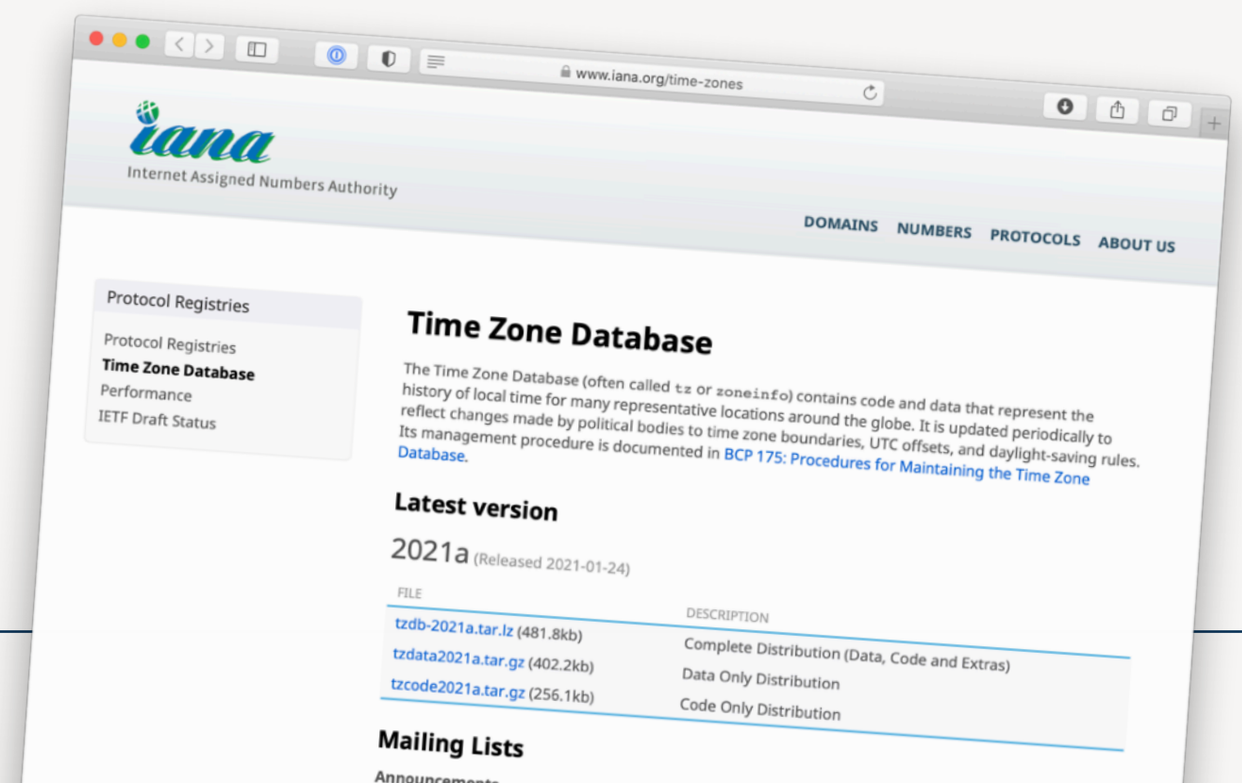
AM/PM

Region: America

City: Los Angeles

The Time Zone Database

- A public resource, hosted by IANA, that provides data that can help people configure automated time conversations on their devices.
- Not intended for end-user consumption, provides data that is imported into software libraries to implement automated conversions
- Contains:
  - Machine-readable descriptions of time zone offsets, and when offsets change based on time/date (to implement DST)
  - Unique identifiers for each of these rulesets, with names based on a population center



```
# DECRETO 267 DE 1993
# https://www.suin-juriscol.gov.co/viewDocument.asp?ruta=Decretos/1061335

# Rule  NAME    FROM    TO      -       IN      ON      AT      SAVE    LETTER/S
Rule    CO      1992    only    -       May      3       0:00   1:00    -
Rule    CO      1993    only    -       Feb      6      24:00   0       -
# Zone  NAME            STDOFF  RULES   FORMAT  [UNTIL]
                #STDOFF -4:56:16.4
Zone    America/Bogota  -4:56:16 -      LMT     1884 Mar 13
                        -4:56:16 -      BMT     1914 Nov 23 # Bogotá Mean Time
                        -5:00   CO      %z
```

```
1629    # Rule  NAME    FROM    TO      -       IN      ON      AT      SAVE    LETTER/S
1630    Rule    Para    1975    1988    -       Oct      1      0:00    1:00    -
1631    Rule    Para    1975    1978    -       Mar      1      0:00    0       -
1632    Rule    Para    1979    1991    -       Apr      1      0:00    0       -
1633    Rule    Para    1989    only    -       Oct     22      0:00    1:00    -
1634    Rule    Para    1990    only    -       Oct      1      0:00    1:00    -
1635    Rule    Para    1991    only    -       Oct      6      0:00    1:00    -
1636    Rule    Para    1992    only    -       Mar      1      0:00    0       -
1637    Rule    Para    1992    only    -       Oct      5      0:00    1:00    -
1638    Rule    Para    1993    only    -       Mar     31      0:00    0       -
1639    Rule    Para    1993    1995    -       Oct      1      0:00    1:00    -
1640    Rule    Para    1994    1995    -       Feb    lastSun  0:00    0       -
1641    Rule    Para    1996    only    -       Mar      1      0:00    0       -
```

```
1657    Rule    Para    1996    2001    -       Oct     Sun>=1  0:00    1:00    -
```

```
1659    Rule    Para    1997    only    -       Feb     lastSun 0:00    0       -
```

```
1662    Rule    Para    1998    2001    -       Mar     Sun>=1  0:00    0       -
```

```
1667    Rule    Para    2002    2004    -       Apr     Sun>=1  0:00    0       -
1668    Rule    Para    2002    2003    -       Sep     Sun>=1  0:00    1:00    -
```

```
1677    Rule    Para    2004    2009    -       Oct     Sun>=15 0:00    1:00    -
1678    Rule    Para    2005    2009    -       Mar     Sun>=8  0:00    0       -
```

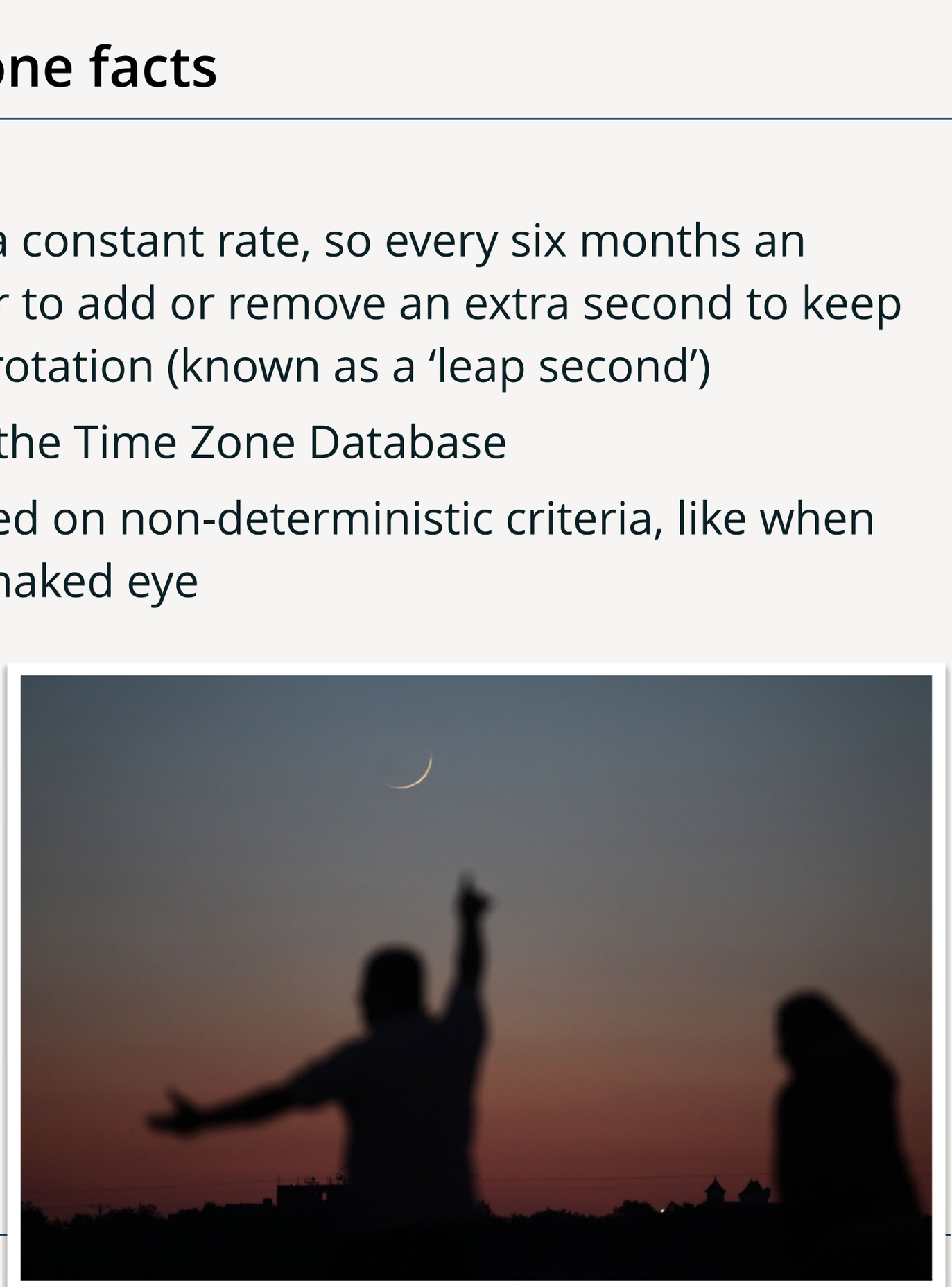
```
1690    Rule    Para    2010    max     -       Oct     Sun>=1  0:00    1:00    -
1691    Rule    Para    2010    2012    -       Apr     Sun>=8  0:00    0       -
```

The Time Zone Database

- It’s not official
  - Based on observations on ‘facts on the ground’
  - Comprehensive notes in the repository explaining sources
  - Tries to source for authoritative sources (e.g. government laws and decrees)
- Has become the defacto world standard for time zone representation
  - Used in most software, operating systems, etc.

Other interesting time zone facts

- The earth is not spinning at a constant rate, so every six months an assessment is made whether to add or remove an extra second to keep UTC in sync with the earth's rotation (known as a 'leap second')
  - These are also tracked in the Time Zone Database
- Some time zones are assessed on non-deterministic criteria, like when the moon is visible with the naked eye



Thank you!

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